REMARKS

Initially, applicant includes drawings which are slightly amended to add further clarification to the invention. Initially, the examiner had objected to the drawings for failing to show the headed part, of claim 5. Actually, the headed part is nothing more than one of those t-shaped connectors that fit within the slider of a structural member, and have its threaded shaft extending through its groove, for use for securing with another part, or structural member, when connecting the frame work of this modular robotic system together. However, this type of fastening member may be used for holding the slide rails, onto the structural members, and securing these two parts together. The use of such bolts or T-shaped threaded members is well known in the art, for use with extrusions, to hold parts together.

The specification has been slightly amended to correct some typographical errors or miss-numbering of parts.

The claims of this application have been substantially amended. Initially, claim 1 as been written as newly added claim 17, and the structure of this modular robotic system, and each of its modular units, is now more aptly described. Essentially, as can be seen from the claim, and as reviewed in the application and the drawings, this modular unit, as defined, included the structural member, the structural member has a slide rail mounted thereto, and then a slide mattingly slides along the slide rail, outside of the structural member, to provide for location for movement of the modular unit. There is an actuator, and a rod, in each of the modular units, that provides for forcefully sliding the slides linearly, along the structural member, when the system is erected, and used for processing of one or more parts.

Claims 2 through 4 have been amended onto claim 17, to define the various control mechanisms used in combination with and in the system, to achieve processing of parts, through the use of one or more of the modular units that are specifically constructed in the manner as described in the claim 17.

Claim 7 has been rewritten as claim 18, and now defines how a series of such modular units can be used together, one mounted onto the other, so as to provide for movement of the parts in at least two axes, during usage. What is to be understood, is that each of these modular units are formed of the same type of structural members, slide rails, slides, and an actuator and rods, to provide for linear movement, within each modular unit, and then when a pair of such units are mounted together, provides for movement of the parts in at least two indexed directions, during employment of the system. Claim 19, which was previously claim 8, defines how there may be three modular units that are integrated together, so as to provide for movement of the machine parts in three different linear axes directions, during usage of the device. Nevertheless, the modular units are all constructed of the same type of components, incorporating a structural member, the slide rails mounted thereon, and the slides, as can be understood.

Claim 9 defines how the machine part may include a rake, a tray, and/or a gripper that are used for processing of the parts, during usage of the system.

Claims 10 through 13 have been canceled from the application, without prejudice.

Claim 14 is now claim 20, and defines how the actuator rod may connect with a rake that can be used for feeding parts, to be machined, in a direction. Claim 21 defines how the rake may include a series of pockets, for receiving and moving the various parts. Claim 22, which was previous claim 16, defines how grippers may be used for picking up the parts, once they are indexed, as by the rake, for further processing.

Newly added claim 23 defines how an open case may be provided around the modular units, for securement, and protections, when they assembled into a system.

Claim 24 defines the specific structure of one unit, incorporating a pair of parallel structural members, each structural member having a slide rail thereon, and slides mounted onto the rails, and which can be moved by an actuator within

its unit structure. Claim 25 defines how a pair of such modular units may be integrated together, the first unit providing for movement in one linear directions and moving the second modular unit in that direction, and the second modular unit also incorporating a pair of structural members, slide rails mounted thereon, slides mounted mattingly to the rails, and then having a plate spanning the two, which when the actuator rod of the second modular unit is activated by its actuator, moves the parts in a second linear direction, relative to the direction of movement generated by the first modular unit. Claim 26 defines how a third modular unit may be incorporated into the structure of the system, so as to provide even a third direction of movement, for the system. Essentially, these movements can be generally analyzed shown by the various axes, disclosed in FIG. 9, wherein the three modular units may move a machine part either in an X direction in addition to a Y direction, and finally, through the third modular unit, into a vertical or Z direction of movement, as may be required for machining of any part being processed by the system.

Initially, reviewing the prior art as cited by the examiner, and in particular as reviewed in Nagai, et al, Nagai does not appear to include any type of slide rail, on a structure, in the first instance, and which has slides mattingly mounted onto a slide rail, externally of the structural part, or forwarding precise and indexed movement to various segments of the system, for shifting a machine part in various directions, during processing through usage of this system. Thus, in the first instance, it is difficult to determine how anticipation can be set forth, upon review of Nagai, in the first instance.

The inventors' state that the structure of the arrangement as shown in the '045 patents utilizes a port means that includes a movement of components within its inner structure, and also does not include any type of extendable rod and can not be used as a rod type actuator, such as defined and claimed for the current invention. In addition, as can be noted, the current invention, as claimed, has its various slide rails externally of its structural member, thus, these slide rails can be provided on any one of four faces, and the slides mattingly mount

onto these exposed slide rails, unlike what is shown and described in the Nagai patent.

The inventors' point out that their design is based on the use of a standard type of rod type actuator. A primary difference between the rod type actuator from a linear slide type, as shown in the prior art, is that it does not contain any ball-bearing rail or linear slide rail outside of its supporting structural member. The type of actuator as shown in the prior art incorporates a rod that is attached to lead screw and bushing, and is designed to exert a force to a moveable object without much precision in linearity or ability to carry a payload perpendicular to the axis of motion.

The inventors' state that the Nagai actuator, by adding the linear guiding rail and the slider, the function of obtaining precision linear motion and load carry and functions are taken inside of the actuator. They state that the goal of the current design is not to use these functions inside the actuator, but to take them outside of the actuator, and assign this function to an external component that can be configured to carry large masses and can be distributed in two or more rail systems to solve a specific load support function. The inventors' state that in the specification, page 4, they describe and compare their claimed device to the apparatuses similar to Nagai. They are referred to as a complete device that is built with its own support mechanical means, are self enclosed and fully integrated linear robotic modules that are produced by various companies. They all contain a motor, lead screw or belt, guiding rail, linear slide, and support structure, identical to what is shown and described in Nagai. These products have been available upon the market for some time. Nagai describes an actuator that has parts of its internal construction, and all components are housed internally inside of a beam, creating a self enclosed actuator.

Nagai states, all components of its actuator are to be held in its beam member, and not out of the beam member, that the beam member has at least two grooves which enable other beam members to be mounted therewith, in said grooves.

The inventors' state that their module is constructed by external mounting by a frame member which includes a self enclosed rod type actuator, a linear slide rail member, provided on the surface of the structural members, so that nothing is mounted inside of a beam member, but rather, everything is external, so that the module units can be combined, to provide multiple directions of movement for the parts to be processed, through usage of this device. This is achieved through the usage of a slide rail that connects to the surface of the structural members, on any one of its surfaces then has the slides provided thereon, for furnishing movement to a part, or another modular unit, as the system is designed and constructed. It does not appear that this could be done with the Nagai type of device.

The inventors' state that one of the main objectives of their invention, as described in the application, is to have a separate self-supporting low cost, device responsible for force, position, and velocity for moving an object or part, and to assign a load carrying, precision linear motion function, to other components such as the rails and slides, located externally, and all motivated by a low cost actuator. The inventors' state that through the use of their modular system, with its actuators, it is one third the cost of other type parts processors that are currently upon the market.

In addition, because of the structure of applicants' invention that utilizes two external side rails, in their preferred embodiment, they can handle the movement of parts that may weigh as much as five hundred pounds (500 lbs.), in every direction. Such can not be performed through the use of the Nagai type of actuators. Technically, the inventors' state that the Nagai type of device, under loaded conditions, the limited usage of that type of device is for supporting a very small payload, typically less than twenty pounds per part. This is versus the current invention, of the same size and magnitude that can handle five hundred pounds of payload, from the same physical size components.

In addition, when a longer stroke is required from the Nagai type of actuator, it needs additional external rail support, that makes its internal rail an

unnecessary duplication of function, at additional cost, as compared to the current invention.

In applicant's invention, the device depicted in the drawings and application, shows a rod of the actuator, that are directly connectable to the slide, or to the plate that spans the slides, and the slide rails, that directly connect to the structural members, and which are secured within the structure of the modular units, within its frame member, all provide ample support for the movement of weighted components, when processed by this system. These components, such as the actuator, the slide rails, and the slides, are all mounted external to the structural frame members, which means that the frames themselves provide for the processing and supporting of the loads, through precision linear multiple motions, facilitates the modular build-up of applicant's invention. When all of these components are internalized, as shown in Nagai, such modular systems are limited, as to what can be fabricated into a system of the Nagai type.

The examiners further review of the claims of this application would be appreciated.

Respectfully submitted,

Paul M. Denk
Attorney for Applicants;
Pat. Off. Reg. No. 22,598
763 South New Ballas Road
St. Louis, Missouri 63l4l
(314) 872-8136

PMD/sm